Investigating the Impact of Climate Change on Oceanic Emissions of Brominated Short-Lived Halocarbons

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Abstract

Halocarbons are very efficient in destroying ozone in the stratosphere and extensive efforts have been made in recent decades to reduce their anthropogenic emissions. However, brominated short lived halocarbons, including bromoform ($CHBr_3$) and dibromomethane (CH_2Br_2), are predominantly emitted by oceans and inject about 5 ppt bromine to the stratosphere. In this study, we investigate the impact of climate change on the changes in their emissions through the end of the century. To do this, we developed a machine learning model to estimate the oceanic concentrations of these compounds up to the year 2100 and then used these data to calculate the oceanic emissions based on the Online Air-Sea Interface for Soluble Species (OASISS) within the Community Earth System Modeling, version 2 (CESM2) model. We then evaluated the impact of RCP8.5 emission scenario on the oceanic emissions of $CHBR_3$ and CH_2Br_2 using the CESM2 model. Our results suggest up to 100% and 40% increases in oceanic concentrations of $CHBr_3$ and CH_2Br_2, respectively, by the end of the century over the western Pacific Ocean, where deep convection during the Asian Summer Monsoon season can provide a very efficient pathway for stratospheric injection. Our findings highlight the impact of anthropogenic emissions on the oceanic emissions of natural ozone depleting substances.

Early Career Scientist

YES, I am an early career scientist.

IGAC Activities

CCMi: Chemistry Climate Model Initiative, ACAM: Atmospheric Chemistry and the Asian Monsoon, TOAR: Tropospheric Ozone Assessment Report, GEIA: Global Emissions Initiative, BBURNED: Biomass Burning Uncertainty: ReactioNs, Emissions and Dynamics, PACES: Air Pollution in the Arctic: Climate, Environment, and Societies